Polarization dependent photonic liquid crystal fiber tunable interferometer

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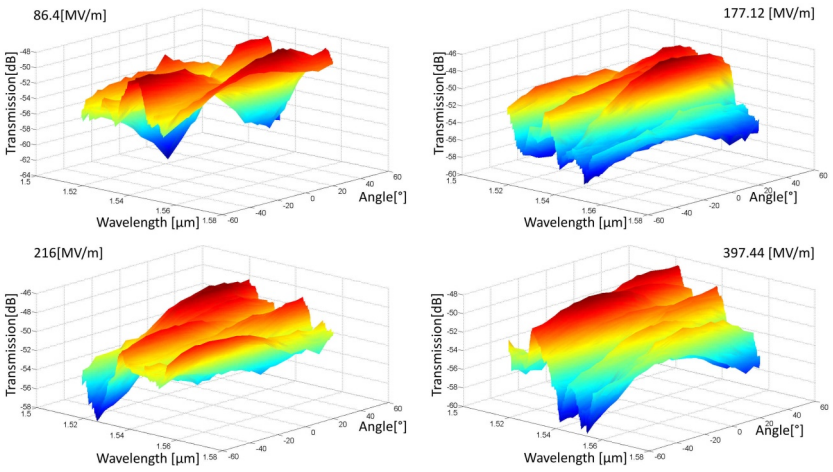
The Polarization Maintaing Photonic Crystal Fiber PM-1550-01 has been employed to create intermodal interferometers by splicing short (cm) portions of PCF between two single mode fiber (SMF) pigtails and PANDA fibers. It has been shown that this setup generates a intermodal interferometer. The interferometers have been made tunable by the inclusion of liquid crystal inside the PCF portion.

Theused LC was a commercial nematic manufactured by Merck MLC-13000. This material shows a dielectric anisotropy $\Delta\varepsilon = 22.8$ and extraordinary and ordinary refractive indices $n_e = 1.6242$ and $n_o = 1.4946$. The purpose was to explore their possible use as photonic sensors or in optical communications systems. Previous studies have demonstrated that PCF Mach Zehender Interferometers can be successfully utilized in these applications [1].

The interference effect appears when a portion (several cm) of PCF is spliced between two standard optical fiber pigtails. Both core and cladding modes can be simultaneously excited at the first splicing point and the light propagates through different optical paths with different group velocities. After propagation through the PCF, the higher order modes are recombined again with the fundamental mode in the second splicing point.



These interferometers are very sensitive to the polarization of the impinging light. For this reason two different configurations of each device have been prepared, having the plane of the cell glasses perpendicular and parallel respectively to the plane containing the thicker holes of the fiber.

[1] Wang, Q., Kong, L., Dang, Y., Xia, F., Zhang, Y., Zhao, Y., Hu , H., Li, J. *High sensitivity refractive index sensor based on splicing points tapered SMF-PCF-SMF structure Mach-Zehnder mode interferometer*. Sensors and Actuators B: Chemical, **225**, 213-220 (2016).

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